Comparison between MC and TB data for muon

Dejing Du

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- Test beam sample: /cefs/higgs/shiyk/Beam_2022/DataBase/Calib/Particle /HCAL_alone/mu+/AHCAL_Run119_20221023_194647 .root
- Simulation sample: • /cefs/higgs/qibh/G4Simulation/Data/SimCalModule/ru n20230216_AHCAL_Data/mu+/BeamData_calo_mu+_ 160GeV.root
- Without event selection
- Events: 100000
- Energy cut: 0.3 MIP (1 MIP = 0.461 MeV)
- The light leakage cell was muted in TB data

Conclusion:

- TB data and MC are matched not well in event energy, event #hit and hit energy
- > TB data have many events with low energy and less #hit \rightarrow event selection



10³

 10^{2}

10³

Count

10⁵ 10⁴ ⊨

10³

10²

500

200

100



Simulation digi

300

Hit energy [MeV]

TB Data



50

60

60

Simulation

TB Data

Simulation

TB Data

Simulation digi

Hit number

Simulation digi

The second se

90 10 Energy [MeV]



- Remove these noise events by event selection
 - Event energy deposition > 15 MeV
 - Event #hit > 25



DRUID, RunNum = 0, EventNum = 229		
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- With event selection:
 - Energy deposition per event > 15 MeV
 - #Hit per event > 25
- Events: 80000
- Energy cut: 0.3 MIP (1 MIP = 0.461MeV)
- The light leakage cell was muted in TB data

Conclusion:

- TB data and MC are still matched not well in event energy, event #hit and hit energy
- > The peaks of TB data are slightly larger than MC
- #Hit per event
 - ➤ TB data is larger than MC
 - TB data have two peaks, and the second peak position is double the first









Simulatior Simulation digi TB Data Contraction of the sector of t 20 30 40 50 60 70 Energy [MeV] Hit Number per event Simulation Simulation digi + TB_Data 70 50 60 80 Hit numbe

Hit energy deposition



Energy deposition per event

Energy deposition per event

Simulation_digi

Energy deposition per event [MeV]

TB Data



TB Data



Event display

- Most of them are two-muon events
- Two muons may be separated by a wide distance
- Small part of them are one muon + ?







- With event selection:
 - Energy deposition per event > 15 MeV
 - #Hit per event > 25
- With hit selection:
 - Just select center 4 cells
- Events: 80000 •
- Energy cut: 0.3 MIP (1 MIP = 0.461 MeV)
- The light leakage cell was muted in TB data

Conclusion:

- Better consistence of peak position between TB data and MC in event energy, event #hit and hit energy
- Most of the two-muon events have been cut



Energy deposition per event

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20

Energy deposition per event

Simulation

TB Data

70

70 80 Simulation digi

Energy [MeV]

120

Hit number

Simulation

TB Data

Simulation

TB Data

1.2 1.4

Simulation digi

1.6 1.8

Hit energy [MeV]

Simulation digi



